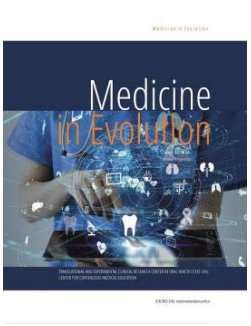
The Influence of Cavity Preparation Method on Children's Dental Anxiety: A Questionnaire-Based Study



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Abstract

Dental anxiety negatively influences children's behaviour in the dental office. Aim and objectives: This study aims to compare anxiety level of children during cavity preparation done by conventional rotary method vs. an atraumatic method. Material and methods: 24 patients treated in the University Clinic of Pediatric Dentistry from Timisoara for dental caries, aged between 6 and 12 years, of both sexes, in which cavity preparation was done via conventional method, using rotary instrumentation, or by atraumatic method, using chemo-mechanical manual instrumentation, participated to the study. The patients were asked to complete the DFS (Dental Fear Survey) questionnaire following the procedure, to assess dental anxiety. The answers, representing a numerical scale, were statistically analysed using the Mann-Whitney U and Kolmogorov-Smirnov tests. Results: The results of the statistical analysis revealed significant differences ($p < 0.05$) between the treatment groups regarding dental anxiety. However, there were no statistically significant differences among different age groups or between sexes ($p > 0.05$). Conclusions: The findings of this study suggest that the use of the chemo-mechanical method for cavity preparation reduces dental anxiety in children, while patient's age and gender do not influence significantly dental anxiety levels.

Keywords: dental anxiety, cavity preparation, rotary, chemo-mechanical

INTRODUCTION

Dental anxiety negatively influences children's behaviour in the dental office, therefore behaviour management of anxious patients is a real challenge in everyday pedodontic practice. It is well known that one of the main reasons why a parent postpones a child's visit to the dentist is the fear generated by the dental environment, both for the parent and the child. The main fears related to dental treatments are triggered by pain, loud sounds and specific smells of materials or solutions used [1,2]. Anxiety and fear responses are common in dental settings, with varying levels of intensity. Approximately 5% of individuals in studied populations experience phobic reactions, which may lead them to avoid dental treatment despite having oral health issues [3,4]. Dental anxiety is frequently seen among 3- to 18-year-olds globally, occurring more frequently in school-aged and preschool children compared to adolescents [4].

The widespread interest in the complex correlation between dental conditions and dental anxiety reflects the significant psychosocial impact that fear-related factors can have on a child's behaviour during dental treatments. These fears are psychological, emotional and cognitive in nature and can even be linked to physiological changes in children as they go through different stages of development [1,5-7].The nature of these fears does not depend only on the age of the child, but can be correlated with intrinsic and extrinsic factors associated with the family and socio-cultural environment such as the influence and experiences of the parents, especially their anxiety, education and socioeconomic status, ethnicity and culture, or the number of siblings. Furthermore, the clinical environment, personal traits, general anxiety and psychological status play a role in manifesting dental anxiety [8-10]. On the other hand, dental anxiety is also in close connection to previous experiences in a dental office. High levels of dental anxiety are noted among children on their first visit to the dentist, which are then expected to decrease with more dental visits, hence having experienced more dental treatments [10,11]. Moreover, the time-frame between the last dental visit and the current one may have a significant impact on maintaining a dental fear and anxiety state during appointments, especially when they are at a long time apart. Armfield et al. observed that children who attend sporadically, often presenting with pain and requiring urgent dental care, report elevated levels of dental anxiety. This pattern of irregular attendance and reactive care can create a vicious cycle, perpetuating and exacerbating long-term anxiety issues [12]. Poor oral health also plays a significant role in initiating dental fear and anxiety in children, especially pre-school children and pre-adolescents [13]. Taking all the above-mentioned aspects into consideration, we can state that the ethology of dental anxiety is multifactorial. Therefore, specialists who treat children and adolescents must carry out a complex assessment of the patient in relation to personal, social and environmental aspects, to gain more knowledge about the individual patient [12] in order to select appropriate behaviour management techniques as well as treatment methods that would minimize discomfort.

Behavioral management is widely recognized as a key element in providing dental treatments for pediatric patients. Before starting the actual pediatric dental treatment, assessing the level of fear and anxiety can aid in managing behavioral issues associated with dental care and make the visit more efficient [14,15]. Tracking the prevalence of dental anxiety is highly beneficial for organizing dental services that prioritize patient comfort and well-being [4]. When managing anxious children, dentists and other professionals need to evaluate the child’s condition and identify the intensity and source of their anxiety, to devise an effective management strategy that facilitates the necessary dental treatment. The initial steps in this process include carefully observing the child’s behavior and physical state,

asking sensitive questions about their feelings and past experiences, and interviewing parents as an additional source of information. This multi-faceted approach aligns with established diagnostic principles, leveraging various methods to improve the accuracy of assessments and minimize misjudgements. In this regard, many reviews emphasize self-report questionnaires as the gold standard for assessing dental anxiety in pediatric patients [16].

Globally, dental caries is an ongoing public health problem, still considered the chronic disease with a high prevalence affecting the majority of children [17]. The use of rotary instruments and dental burs in the treatment of dental caries is a well-known source of dental anxiety, due to the vibrations and noise triggered by the handpiece, and potentially also pain. In recent decades, advances in cariology and dental materials have brought new approaches in dentistry to the treatment of caries [18,19]. Chemo-mechanical caries removal (CMCR) is a minimally invasive method that uses a chemical agent to remove infected dentin. This technique avoids pulp irritation and patient discomfort while removing infected tissue and maintaining healthy tooth structure. This method of caries removal uses dissolution instead of rotary drilling and chemical agents along with atraumatic mechanical force to remove the infected dentin [19,20]. In clinical practice, CMCR was proven effective in diminishing anxiety in children treated by this method [21].

Aim and objectives

The present study aims to assess the anxiety level in 6-12 years old children, during treatment of dental caries. The anxiety of children treated by two different methods of cavity preparation – the conventional rotary method and the chemo-mechanical atraumatic method is assessed in relation to sex and age of the children.

MATERIAL AND METHODS

The target population of the study was represented by paediatric patients aged between 6 and 12 years, treated for dental caries in the Pediatric Dentistry University Clinic of the" Victor Babeş" University of Medicine and Pharmacy from Timişoara, Romania. Inclusion criteria were: patients aged 6-12 years, both sexes, patients with simple caries in primary and/or permanent teeth, patients in which caries excavation was done by conventional rotary method, and/or by atraumatic chemo-mechanical method, patients with dental anxiety, patients who have the ability to understand the questions from the given questionnaires. Exclusion criteria were: patients outside the mentioned age range, patients with complicated caries, totally uncooperative patients, patients that could not comprehend the questions from the given questionnaires.

The present work is a non-interventional, observational study that analyses the relationship between dental anxiety and the two preparation techniques, considering two variables: age and sex of the children. A total of 24 patients, 13 girls and 11 boys participated in the study. They were divided in two groups, based on the cavity preparation method used: Group 1 – patients in which the cavity preparation was done via the conventional method, using rotary instrumentation – low speed handpiece and round carbide burs, and Group 2 – patients in which the cavity preparation was done atraumatically, via the chemo-mechanical method, using enzymatic gels and manual excavation. The preparation method used was selected for the patient by the attending pediatric dentist, based on behaviour assessment from previous dental visits, uninfluenced by the present study. Following the procedure, the patients were asked to complete a questionnaire regarding anxiety felt during the treatment. Informed consent was obtained from the parents of the respondents for the application of the questionnaire.

Data collection was performed by applying a questionnaire, based on the Dental Fear Survey (DFS) imagined by Ronald A. Kleinknecht. The DFS was translated to romanian and adapted for the target population, for an easy understanding. The DFS is composed of 12 questions, out of which 7 assess fears of specific stimuli/situations and the remaining 5 assess patients' physiological arousal. Each question has 5 answer options, which represent a scale from 1 to 5 with the following significance: ”never” – 1, ”once or twice – 2, ”a few times” – 3, ”often” – 4, ”nearly every time” – 5 (22).

The research assumed the validation of the following research hypotheses:

1: The chemo-mechanical preparation method significantly reduces dental anxiety compared to the conventional method.

2: Dental anxiety levels are lower in older children, regardless of the preparation method used.

3: Girls present higher levels of dental anxiety compared to boys, regardless of the preparation method used.

In this study, the statistical analysis of data was performed with IBM SPSS v.20 statistical software. Two statistical tests were used: Mann-Whitney U and Kolmogorov-Smirnov to evaluate and compare the impact of the chemo-mechanical method and the conventional method of carious cavity preparation on dental anxiety in children. The statistical significance level was considered to be the *p*-value of 0.05.

RESULTS

In the first stage of the statistical analysis, the homogeneity of the research groups was verified, by applying Levene's test. This test is most commonly used to assess the homogeneity of variances between two or more groups. The results indicate that the variances for all categories are homogeneous in both groups (G1 and G2) – Figure 1. This suggests that the distributions of anxiety responses are similar in terms of variances between groups, allowing a valid comparison between groups within the performed statistical analyses.

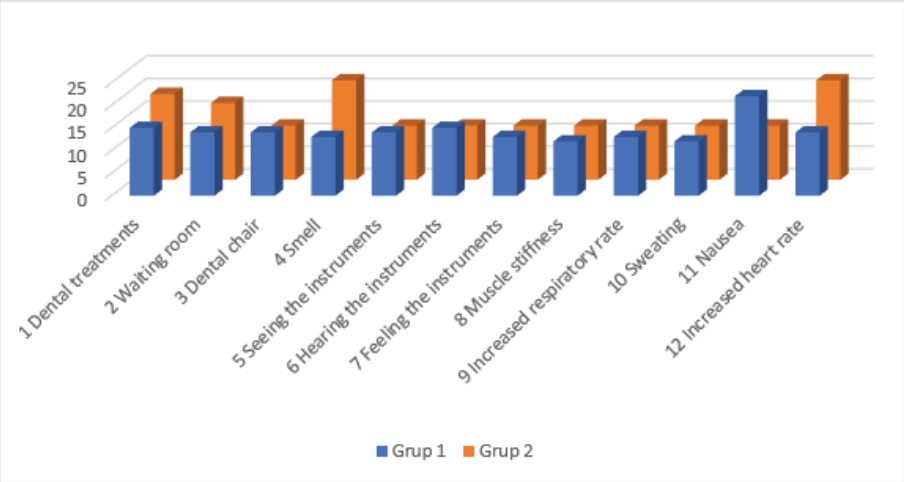

Figure 1. Variance of the answers to the 12 questions between the two groups: Group 1 – conventional rotary preparation method, Group 2 – chemo-mechanical manual preparation method

The results of the comparative analyses between the responses of the patients in the two groups, performed using the Mann-Whitney U și Kolmogorov-Smirnov statistical tests, indicate that for most categories (excepting the score 3 - "A few times"), there are statistically

significant differences ($p < 0.05$) – Table 1 and 2. This suggests that the perception of the preparation method differs significantly between Group 1 and Group 2. Regarding the considered variables – age and sex of the subjects, there are no statistically significant differences between the answers to the questions analyzed, neither according to the age categories ($p > 0.05$), nor according to sex categories $p > 0.05$), for both groups (Group 1 and 2).

Table 1. Results of Mann-Whitney U test

Category	U Statistic	p-value
a) Never	10.0	0.000169
b) Once or twice	1.0	0.000034
c) A few times	42.0	0.080216
d) Often	144.0	0.000023
e) Nearly every time	138.0	0.000032

Table 2. Results of Kolmogorov-Smirnov test

Category	D Statistic	p-value
a) Never	0.75	0.001497
b) Once or twice	0.916667	0.000018
c) A few times	0.416667	0.255775
d) Often	1.0	0.000001
e) Nearly every time	0.916667	0.000018

DISCUSSIONS

In this study, the impact of two different preparation methods (conventional and chemo-mechanical) on the dental anxiety in children was evaluated comparatively. The influence of age and gender on the levels of dental anxiety in this context was also analysed.

Regarding the first research hypothesis, according to which the chemo-mechanical preparation method significantly reduces dental anxiety compared to the conventional method, the results showed statistically significant differences between the responses of the two groups for most categories (Table 1 and Table 2) This suggests that the chemo-mechanical method has a significant positive impact on reducing dental anxiety. Thus, this hypothesis is validated by the obtained data.

For the second hypothesis, which states that the levels of dental anxiety are lower in older children, regardless of the treatment method, results of the Mann-Whitney U test were not statistically significant for any of the questions analysed, across all ages. This suggests that age does not significantly influence levels of dental anxiety, contrary to the original hypothesis and to other studies that found increased anxiety levels in younger children [23]. In contrast, some authors suggest that dental anxiety tends to increase with age [24,25]. This finding may be attributed to confounding factors, such as a higher likelihood of previous painful dental experiences over time [10].

Regarding the third hypothesis, which assumes that girls show higher levels of dental anxiety compared to boys, regardless of the treatment method used, the results of the gender-specific Kolmogorov-Smirnov test for both groups showed no statistically significant differences between children's responses by gender for each response category. This suggests that gender does not significantly influence the perception of dental anxiety, contrary to the original hypothesis, and to other studies that reported increased anxiety levels in female patients [26,27], or in male patients [23], but in accordance with Popescu et al. [28] who reported no differences between genders for a Romanian population as well.

Within this research, several limitations were identified that could influence the interpretation of the results and their applicability in clinical practice. The small sample size

limits the extrapolation of the results to a wider population. Future studies should include a larger number of participants to obtain more robust and representative data. Participants were selected from a single clinic, which may introduce a selection bias. Extending the study to multiple locations and including a diverse sample could improve the external validity of the results. Assessment of dental anxiety was based on patient self-report questionnaires, which may introduce subjectivity and variability in responses. Especially in young children, the level of understanding and ability to accurately communicate their emotions can vary considerably. Using additional objective methods, such as measuring heart rate or cortisol levels, could provide a more accurate assessment of anxiety. By addressing these limitations, future research can contribute to a better understanding of dental anxiety in children and to the development of more effective strategies for its management in pediatric dental practice.

In today's pediatric dentistry, there is an increased preoccupation for the patient's comfort during the procedures. In this regard, minimally invasive techniques are gaining more and more interest. The CMCR method is comfortable for patients, reducing pain and anxiety, as well as the need for local anaesthetic. In current pediatric dental practice, the CMCR method considered a viable alternative to the conventional caries removal method, despite the longer duration of the treatment and higher costs [20].

A study published in 2019 [29] evaluated and compared the difference between the chemo-mechanical method (with Brix 3000) and the rotary method (with a ceramic bur) for the removal of dental caries. The mentioned study included an anxiety rating scale (during and after treatment). The study examined a sample of thirty children between the ages of eight and twelve who had bilaterally cavitated carious permanent molars. During treatment with the rotary tool (ceramic bur), the children showed a deterioration in their behaviour from positive to negative. In contrast, in the Brix 3000 group there was no change in the children's behaviour during treatment. The results of this study showed that the chemo-mechanical method had a beneficial impact on the behavioural management of the participating children, being consistent with the results obtained in the present study. Another study, published in 2021 by Lazarova et al. [30], concluded that children's age does not determine differences in the level of fear; Similar to our results, they found that cavity excavation in combination with enzyme-based gel reduces fear of dental treatment in children compared with conventional treatment by drilling with rotary instruments.

CONCLUSIONS

The findings of this study suggest that the use of the chemo-mechanical method for cavity preparation reduces dental anxiety in children, while patient's age and gender do not influence significantly dental anxiety levels.

Widespread implementation of the chemo-mechanical method in pediatric dental practice could significantly contribute to the reduction of dental anxiety, thus improving the experience of children in the dental office. Further research is also recommended to better understand the factors influencing dental anxiety and to develop tailored interventions for different patient groups.

Conflicts of Interest

The authors declare no conflict of interest.

REFERENCES

[1] De Menezes Abreu DM, Leal SC, Mulder J, Frencken JE. Dental anxiety in 6-7-year-old children treated in accordance with conventional restorative treatment, ART and ultra-conservative treatment protocols. Acta Odontol Scand. 2011;69(6).

[2] Themessl-Huber M, Freeman R, Humphris G, MacGillivray S, Terzi N. Empirical evidence of the relationship between parental and child dental fear: A structured review and meta-analysis. Int J Paediatr Dent. 2010;20(2).

[3] Armfield JM, Ketting M. Predictors of dental avoidance among Australian adults with different levels of dental anxiety. Heal Psychol. 2015;34(9).

[4] Grisolia BM, dos Santos APP, Dhyppolito IM, Buchanan H, Hill K, Oliveira BH. Prevalence of dental anxiety in children and adolescents globally: A systematic review with meta-analyses. Int J Paediatr Dent. 2021;31(2).

[5] Carrillo-Diaz M, Crego A, Armfield JM, Romero-Maroto M. Assessing the relative efficacy of cognitive and non-cognitive factors as predictors of dental anxiety. Eur J Oral Sci. 2012;120(1).

[6] Versloot J, Veerkamp J, Hoogstraten J. Dental anxiety and psychological functioning in children: its relationship with behaviour during treatment. Eur Arch Paediatr Dent. 2008;9 Suppl 1.

[7] Gao X, Hamzah SH, Yiu CKY, McGrath C, King NM. Dental fear and anxiety in children and adolescents: Qualitative study using youtube. J Med Internet Res. 2013;15(2).

[8] Abanto J, Vidigal EA, Carvalho TS, de Sá SNC, Bönecker M. Factors for determining dental anxiety in preschool children with severe dental caries. Braz Oral Res. 2017;31.

[9] Busato P, Garbin R, Santos C, Paranhos L, Rigo L. Influence of maternal anxiety on child anxiety during dental care: cross-sectional study. Sao Paulo Med J. 2017;135(2).

[10] Alasmari AA, Aldossari GS, Aldossary MS. Dental anxiety in children: A review of the contributing factors. J Clin Diagnostic Res. 2018;12(4).

[11] El-Housseiny AA, Merdad LA, Alamoudi NM, Farsi NM. Effect of child and parent characteristics on child dental fear ratings: Analysis of short and full versions of the children's fear survey schedule-dental subscale. J Oral Heal Dent Manag. 2015;14(1):9–16.

[12] Shindova MP, Belcheva AB. Dental Fear and Anxiety in Children: a Review of the Environmental Factors. Folia Med (Plovdiv). 2021;63(2).

[13] Nicolas E, Bessadet M, Collado V, Carrasco P, Rogerleroi V, Hennequin M. Factors affecting dental fear in French children aged 5-12 years. Int J Paediatr Dent. 2010;20(5).

[14] Preda DM, Dragnea (Bărîcă) A, Dănilă DI, Muntean A. Child behavior management technology in pediatric dentistry. Review of non-pharmacological techniques. Psihiatru.ro. 2022;2(69).

[15] Ummat A, Dey S, Anupama Nayak P, Joseph N, Rao A, Karuna YM. Association between dental fear and anxiety and behavior amongst children during their dental visit. Biomed Pharmacol J. 2019;12(2).

[16] Margraf-Stiksrud J, Pieper K. Assessment of Dental Anxiety in Children: Reliability and Validity of the Questionnaire to Assess Dental Anxiety in Children (QADA-C). Dent J. 2024;12(2).

[17] Mahdi M, Ismail M, Haidar A, Al Haidar MJ. Evaluation of the Efficacy of Caries Removal Using Papain Gel (Brix 3000) and Smart Preparation Bur(in vivo Comparative Study). 2019;11(2):444–9.

[18] Alia S, Khan SA, Navit S, Sharma A, Jabeen S, Grover N, et al. Comparison of pain and anxiety level induced by laser vs rotary cavity preparation: An in vivo study. Int J Clin Pediatr Dent. 2020;13(6).

[19] CK Y, MF B. Caries management: A journey between Black's principles and minimally invasive concepts. . Int J Dent Oral Sci. 2015;2:120–5.

[20] Maashi MS, Elkhodary HM, Alamoudi NM, Bamashmous NO. Chemomechanical caries removal methods: A literature review. Saudi Dent J. 2023;35(3).

[21] Hemalatha R, Nirmala S, Viswaja K. Anxiety Perception Among Children Following Two Different Restorative Modalities – A Noninferiority Randomized Clinical Trial. J Prim Care Spec. 2022;3(3).

[22] Milgrom P, Kleinknecht RA, Elliott J, Hsing LH, Choo-Soo T. A cross-cultural cross validation of the dental fear survey in South East Asia. Behav Res Ther. 1990;28(3).

[23] Klingberg G, Broberg AG. Dental fear/anxiety and dental behaviour management problems in children and adolescents: A review of prevalence and concomitant psychological factors. Int J Paediatr Dent. 2007;17(6).
[24] Akbay Oba A, Dülgergil ÇT, Şaroğlu Sönmez I. Prevalence of dental anxiety in 7- to 11-year-old children and its relationship to dental caries. Med Princ Pract. 2009;18(6).
[25] Rantavuori K, Hausen H, Tolvanen M, Lahti S, Seppä L. Factors associated with different measures of dental fear among children at different ages. J Dent Child. 2009;76(1).
[26] White AM, Giblin L, Boyd LD. The Prevalence of Dental Anxiety in Dental Practice Settings. J Dent Hyg JDH. 2017;91(1).
[27] Peretz B, Nazarian Y, Bimstein E. Dental anxiety in a students' paediatric dental clinic: Children, parents and students. Int J Paediatr Dent. 2004;14(3).
[28] Popescu SM, Dascălu IT, Scrieciu M, Mercuț V, Moraru I, Țuculină MJ. Dental Anxiety and its Association with Behavioral Factors in Children. Curr Heal Sci J. 2014;40(4).
[29] Ismail MMM, Al Haidar AHMJ. Impact of Brix 3000 and conventional restorative treatment on pain reaction during caries removal among group of children in Baghdad city. J Baghdad Coll Dent. 2019;31(2).
[30] Lazarova Z, Tankova H, Rashkova M. Fear Assessment With the 'Draw a Person' Test of the Dental Treatment in Sparing Enzyme-Based Excavation of Caries in Children Between 4 and 6 Years of Age. J IMAB. 2021;27(4):4043–7.